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ESTIMATES OF GENETIC PARAMETERS OF FIRST LACTATION TRAITS IN CROSSBREED HARDHENU (Bos Taurus x Bos indicus) CATTLE

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ABSTRACT

Records of 192 Hard henu cattle pertaining to first lactation traits over a period of 6years from 2008 to 2014were collected from history cum pedigree sheets maintained at Cattle breeding farm, Department of Animal Genetics and Breeding Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Data were analysed by LSML(Harvey, 1990) using mixed linear model having effect of sire as random and that of year and season of calving as fixed. The first lactation traits studied were first lactation milk yield (FLY), first lactation length (FLL) first service period (FSP) and first calving interval (FCI). The overall least squares means FLY, FLL, FSP and FCI were averaged as 2392.92±70.45 kg,317.70±15.87days, 160.20± 18.08 days and 448.90± 15.13 days, respectively. The effect of period of calving was not significant for all the first lactation traits under study except for FSP. Similarly, the effect of season of calving was not significant for all the first lactation traits except for FSP. The heritability estimates for different first lactation traits were obtained as 0.27±0.34, 0.14±0.39, 0.13±0.38and 0.21±0.26forFLY, FLL, FSP and FCI, respectively. The genetic correlation among first lactation traits were positive and varied from 0.16 to 0.59 except the genetic correlation of FLL with FSP and FCI which was low and negative. The phenotypic correlation among first lactation traits were low to high positive and varied from 0.11 to 0.76, respectively.

KEYWORDS: Genetic Factors, Hard Henu, Non-Genetic Factors & First Lactation Traits

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INTRODUCTION

India, with its 190.9 million heads of cattle has the largest cattle population in the world, out of which 39.73 thousand is comprised of crossbreed. The exotic/crossbred milch cattle increased from 14.4 million to 19.42 million, giving rise to an increase of 34.78% whereas the indigenous milch cattle increased marginally from 48.04 million to 48.12 million, an increase of 0.17% (19th livestock census-GOI). The economy of India is largely dependent on livestock. To improve the supply of milk and milk products cattle breeding has been implemented for several years. Genetic parameters are important tools for improving quantitative traits by selection. The estimates of genetic parameters are helpful in determining basis of selection. and the prediction of response and correlated response to selection.

The genetic correlation give the information how genes affecting one trait also affect the other trait. The effectiveness of selection and net genetic progress can be measured when selection made for more than one trait (Javed*et al.*, 2004). Keeping in view, the above facts available through the literature on this species of livestock indicated immense opportunities for the evaluation of genetic parameters and devising appropriate selection indices utilizing Information on first lactation trait is useful in deciding the selection criteria of relatives. The present investigation was undertaken to estimate the phenotypic and genetic parameters of first lactation traits in Hardhenu crossbredcattle.

MATERIAL AND METHODS

Data on 192 crossbredheifers progeny of 30 bullspertaining to first lactation traits over a period of 6 years (2008-2014) were collected from history cum pedigree sheets maintained at the Department of Animal Genetics and Breeding LalaLajpat Rai University of Veterinary and Animal Sciences, Hisar. Animals having lactations shorter than 100 days, suspected outliers on the basis of histograms and abnormal records like abortion, mastitis and chronic illness were excluded from present study. Traits included were:first lactation milk yield (FLY), first lactation length (FLL), first service period (FSP) and first calving interval (FCI). Each year was further delineated into 4 seasons of calving according to the prevailing agro-climatic conditions in the region:Summer : April-June; Rainy : July-September; Autumn : October-November; Winter : December-March. In order to overcome non-orthogonality of the data due to unequal subclass frequencies, least squares and maximum likelihood computer program of Harvey (1990) was utilized to estimate the effect of various tangible factors on early performance traits. Genetic parameters were estimated by the Henderson's method 3 using paternal half sib correlation (Henderson, 1973).

The following model was used to explain the underlying biology of the traits included in the study:

$Y_{ijkm}=\mu+S_i+ Year_j+ seas_k+e_{ijkm}$

Where,

Y_{ijklm}= m^{th} observation on the progeny of the i^{th} sire belonging to j^{th} year k^{th} season,

S_i= Random effect due to i^{th} sire,

$Year_{j=}$Fixed effect of j^{th} Year (year of birth for performance traits),

$Seas_k$= Fixed effect of k^{th} season (season of birth for performance traits and

e_{ijkm} =Random error associated with every observation assumed to NID (0, σ^2_e).

RESULTS AND DISCUSSIONS

The overall least squares means for FLY, FLL, FSP and FCI were 2392.92±70.45 kg, 317.70±15.87 days, 160.20± 18.08 days and 448.90± 15.13 days, respectively (Table-2). The present estimate for FLY were in agreement as reported by Thakur and Singh (2000), Akhter *et al.* (2003) and Yadav *et al.* (2004). The estimates reported by Sahana and Gurnani (2000), Singh and Gurnani (2004) and Singh *et al.* (2008) are on higher side, whereas, those reported by Das *et al.* (2001), Bhattacharya *et al.* (2002) and Ahmed *et al.* (2004) are on lower side in crossbred cattle. The year of birth as well as season of birth did not affect FLY significantly (Table-1). The present findings are in agreement with the findings of Raja and Narula (2007) and Veraparsad*et al.* (2013) as they reported non-significant effect of season of birth on lactation

traits. On the contrary, Petrovic*et al.* (2009) observed significant effect of season and year of birth on all the lactation traits. The average FLL 317 days in the present study (Table-2) is in close agreement with that reported by Thakur and Singh (2001), Das *et al.* (2001) and Akhter *et al.* (2003). However, higher estimates have been reported by Ahmed *et al.* (2004), Singh and Gurnani (2004) and Singh *et al.* (2008). Thakur and Singh (2000) reported lower estimates than that obtained in present study. The year of birth as well as season of birth did not affect FLL significantly (Table-1).

Table 1: Analysis of Variance for First Lactation Traits

Source of Variation	Degree of Freedom	Mean Squares			
		FSP(Days^2)	FCI(Days^2)	FLY(Kg^2)	FLL(Days^2)
Sire	29	17187.02	15529.87	534162.20	13992.95
Year of Birth	6	18442.52*	11714.08	815247.74	8147.83
Season of Birth	3	42496.93**	5773.97	1361458.17	9535.35
Residual	157	7609.22	10136.38	648308.68	6892.63

*(P<0.05), ** (P<0.01);

The present findings are in agreement with those of Veraparsad*et al.* (2013), Thakur and Singh (2000 and 2001) and Thakur and Singh (2007) who observed non-significant effect of season of birth on FLL. The average FSP 160 days in present study iswithin the range reported by Chaudhary *et al.* (2013) and Kharkar*et al.* (2010). The estimates reported by Dongre*et al.* (2011) and Dubey and Singh (2005) are on higher side, whereas, those reported bySahana and Gurnani (2000) and Das *et al.* (2001) are on lower side. The year of birth and season of birth had significant effect on FSP. The FSP was the lowest for the heifer born during year 2006 (85 days) and the highest for those born during year 2007 (246 days). The heifers born in rainy season are having the lowest FSP (110 days), whereas, those born in autumn had the highest FSP (195 days).

Table 2: Least Squares Means Along With Standard Errors for First Lactation Traits

Factor	No of Animals	FSP(days)	FCI(days)	FLY(kg)	FLL(days)
Overall mean	196	160.20± 18.08*	448.90± 15.13	2392.92± 70.45	317.70± 15.87
Year of birth					
2004	24	164.51± 60.41^{c}	496.80± 68.23	3142.21±536.68	360.00± 57.11
2005	40	174.46± 34.65^{cd}	466.93± 37.32	1772.41±281.81	266.49± 32.30
2006	20	85.52± 38.20^{a}	444.90± 41.68	2282.33±318.47	322.99± 35.74
2007	49	246.59± 36.56^{e}	486.28± 39.68	1920.41±301.67	283.55± 34.16
2008	15	204.89± 44.42^{d}	528.84± 49.21	2517.77±381.07	380.41± 41.75
2009	37	120.21± 79.42^{ab}	273.37± 90.53	2643.05±717.31	317.20± 75.30
2010	11	125.25± 50.41^{b}	445.21± 56.38	2472.28±440.05	293.25± 47.52
Season of birth					
Winter	38	169.13± 24.10^{b}	461.82± 23.81	2458.69±163.03	342.90± 21.95
Summer	51	166.37± 22.94^{b}	429.51± 22.24	2384.62±148.15	317.83± 20.80
Rainy	83	110.15± 21.36^{a}	454.94± 20.03	2120.05±126.45	296.66± 19.22
Autumn	24	195.16± 26.09^{b}	449.35± 26.46	2608.33±187.31	313.40± 23.92

Means with different superscripts within a specific source in a column differ significantly

The average FCI was 448 days, which is in close agreement with those reported by Singh and Gurnani (2005), Saha*et al.* (2010) and lower than that reported by Yadav *et al.* (2004), Islam *et al.* (2004), Singh *et al.* (2008) and Thakur and Singh (2000). The year of birth and season of birth had non- significant effect on FCI in the present study.

Heritability Estimates and Genetic and Phenotypic Correlations Among First Lactation Traits

The heritability estimates were 0.27±0.34, 0.14±0.39, 0.13±0.38and 0.21±0.26forFLY, FLL, FSP and FCI, respectively (Table-3).

Table 3: Heritability (Diagonal), Genetic (Above Diagonal) and Phenotypic (Below Diagonal) Correlations among First Lactation Traits

	FSP	FCI	FLY	FLL
FSP	**0.13±0.38**	0.16±0.19	-0.15±0.40	0.59±0.21
FCI	0.71±0.05**	**0.21±0.26**	-0.10±0.46	0.49±0.32
FLY	0.30±0.07**	0.11±0.07	**0.27±0.34**	0.66±0.21
FLL	0.48±0.06**	0.18±0.07*	0.76±0.05**	**0.14±0.39**

*(P<0.05), ** (P<0.01)

These estimates of heritability were low to moderate. The FSP had the lowest (0.13) and the FLY had the highest (0.27) heritability. The heritability estimate for FLY in the present study is higher than that reported by Saha*et al.* (2010) and Subhalaxmi*et al.* (2010) and the estimate for FLL is also higher than that reported by Ahmed *et al.* (2004), Singh and Gurnani (2004), Kumar *et al.* (2008) and Subhalaxmi*et al.* (2010). Heritability estimate for FSP in the present study is in agreement with that reported bySingh and Gurnani (2004) in Karan Fries cattle. Estimate of heritability for FCI was (0.21) in the present study is lower than the estimates reported by Dubey and Singh (2005) and Saha*et al.* (2010).

The FLL had positive and high genetic correlation with FSP (0.59), FCI (0.49) and FLY (0.66). The FSP had moderate to high and positive phenotypic correlations with FCI (0.71), FLY (0.30) and FLL (0.48). The FLL had high and positive phenotypic correlation with FLY (0.76) (Table-3). The correlation between FLL and FLY is comparable with that reported by Dubey and Singh (2005) and Kumar *et al.* (2008). However, Singh and Gurnani (2004) and Saha*et al.* (2010) reported lower genetic correlation between FLL and FLY. The estimate of genetic correlation between FLL and FCI is comparable with that reported by Singh and Gurnani (2004) and Dubey and Singh (2005). However, Saha*et al.* (2010) reported lower genetic correlation (0.08) between these two traits. A higher association (0.59) between FLL and FSP was obtained at genetic level in present study which is supported by Singh and Gurnani (2004) and Saha*et al.* (2010). The high and positive phenotypic correlation between FLY and FLL (0.76) is in agreement with that reported by Bhattacharya *et al.* (2002), Dubey and Singh (2005) and Saha*et al.* (2010), while Singh and Gurnani (2004) reported comparatively lower phenotypic correlation between the two traits. The correlations of FSP with FLY and FLL are similar to that reported by Singh and Gurnani (2004) and Saha*et al.* (2010).

High genetic and phenotypic correlations between FLL, FSP and FCI are due to the fact FLL and FSP are components of FCI. High correlations between FLY and FLL suggest that high yielding animals lactate for longer duration. Therefore, selection on the basis of first lactation yield is recommended because FLY had moderate estimates of heritability and high and positive genetic correlations with other first lactation traits.

CONCLUSIONS

The study revealed that selection on basis of first lactation traits is practically feasible as they are expressed earlier in the life of animal and should be included in selection criteria. The high genetic and phenotypic correlations of FLY and FLL with other early production traits indicate that there are some common genes which govern the expression of these traits. Therefore, selection on the basis of first lactation milk yield as expressed earlier in life, is recommended because FLY had moderate estimates of heritability and high and positive genetic correlations with other lactation traits and it

would also take care of other production and reproduction traits through correlated response. Negative correlations between production and reproduction traits suggested that increase in length of first service period and first calving interval will reduce the first lactation milk yield and first lactation length.

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